



TEMPERATURE VARIABILITY AND ITS IMPLICATIONS FOR AQUACULTURE SUSTAINABILITY

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ABSTRACT

The world population is rising, and technological measures must be taken to provide food security, particularly for the essential animal protein required by the expanding human population. Several initiatives are devoted to fish production to meet the need. Aquatic ecosystems have been studied by establishing fish production facilities (Aizonou et al., 2021). Fish is an important source of animal protein that humans need to maintain their health. It contains omega-3 fatty acids necessary to protect humans from heart and circulatory diseases. Fish protein is characterized by ease of digestion, absorption, and representation compared to the protein found in meat and poultry (Yue et al, 2020).

Fish is a cheap source of animal protein for our food. Fish production includes the finned true fish as well as shellfish such as prawns and molluscs. There are two ways of obtaining fish. One is from natural resources, which is called capture fishing. The other way is by fish farming, which is called culture fishery.

The water source of the fish can be either seawater or freshwater, such as in rivers and ponds. Fishing can thus be done both by capturing and culture of fish in marine and freshwater ecosystems. The state has brought fish culture to about 90% of the total area suitable for aquaculture. Centrally sponsored scheme Rashtriya Krishi Vikas Yojana (RKVY) had a clear impact which was implemented in 2007 and during that period the growth in Chhattisgarh fisheries was 13.8%. The shows Government hatcheries 2016-17, 2017-18, 2018-19, 2019-20, 2020-21- 3.77 lakh tone 4.57 lakh tone 4.89 lakh tone 5.37 lakh tone 5.77 lakh tone Fish Production Growth production.

KEYWORDS: Chhattisgarh Aquaculture, Cage Culture, Growth Performance (Fish Production), Temperature Influence

INTRODUCTION

The primary production and fish production patterns in temperate and tropical ponds under different management practices are described. An attempt is made to understand the relation between the two under the given conditions. With a more or less narrow range of primary production, varying fish production and conversion efficiencies were recorded, indicating the influence of a combination of environmental and management factors. The constraints involved in establishing the relationship are discussed.

The study of freshwater resources is necessary in connection with water supply and fisheries. In both cases, the major biological problem is concerned with productivity. In either case i.e. for increasing or decreasing biological productivity of inland waters, it is necessary to know the production of life which centers on the plankton in the water and deep deposits. Ruttner (1963) discovered that all life inhabiting waters is conditioned by two factors. The one is the physical factor and the second is a chemical factor that can influence the primary productivity of water. Hence the physico-chemical parameters are necessary aspects in the study of limnology. The biota flourishing in natural water is influenced by Temperature, pH, Transparency, Hardness, Total alkalinity, Dissolved oxygen, Free CO₂, Cl⁻, etc., and climatic conditions also play a very

important role in the occurrence and distribution of aquatic biota.

Chhattisgarh is rich in freshwater resources. It is estimated that 59,887 hectares of water bodies are readily available for fish culture (Govind 1988). A large number of unutilized water bodies in the village areas, mines, and stone quarries filled with water during the rainy season has not been much studied.

Description of The Site Of Research

Godhi Borsi Pond is situated in Dhamdha Tahsil of Durg district of Chhattisgarh state. Chhattisgarh is unique in the sense that it has no sea connection with the Himalayas and yet it has hills and Mountains. Chhattisgarh is very rich in its natural resources, beautiful Fauna, and flora including many rivers, lakes, and ponds. The water of this pond is primarily utilized culture of fish. The pond is a man-made moorom soil, in this pond fish culture was started in 2018.

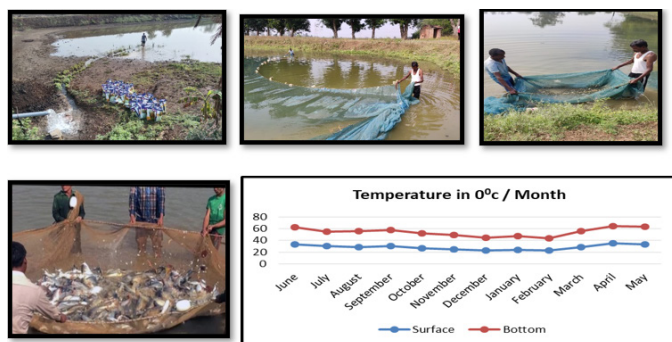
MATERIAL AND METHODS

Investigation of the Pond is the prime consideration to assess the quality of water for its best usage for fish culturing to know the pollution strength and its effect on the ecology of the pond. The pond was developed from abandoned moorom soil and the bottom has stone Chips with a high seepage rate. The total

water area of the pond is around one hectare. Now this pond is primarily utilized for fish culture in various ways. The pond is mainly rain-fed and receives runoff water from agricultural lands, and the domestic drainage of the surroundings.

Monthly samples were collected from the station for a period of 12 months from June to May. The water samples (surface and bottom) were collected with the help of Ruttner's sampler in the morning hours; water samples were brought in one litter container to the laboratory for analysis. Parameters like Temperature, transparency, pH, Dissolved oxygen, Free CO₂, and Alkalinity were analyzed at the study center itself, whereas parameters viz. chloride, Total hardness, and calcium hardness were analyzed in the laboratory. However, this study outlines only the impact of temperature on Fish Productivity.

For the collection of fish, the fisherman was taken, and the fish were caught with the help of fish gill net and dragnet which are commonly used in this region. Assessment of fish production was done by the methods described by Noriega (1979), Natrajan (1979), Govind (1988) Adholia (1992) & Datta (2006).



RESULT AND DISCUSSION

Physical conditions of water play an important role in the productivity of the pond. Depth, temperature, or transparency are the important physical parameters on which the productivity of a pond depends. The development of both the flora and fauna is greatly influenced by the chemical characteristics of the water. The water must be sufficiently rich in nutrients, and salts and free from toxins. Mineral elements must be present in sufficient quantities.

According to Ruttner (1963), all life inhabiting the waters is conditioned by twofold factors. The one is the physical factor and the second is the chemical factor which can influence the primary productivity of water.

The important physical and chemical characteristics of pond water are discussed below:

Temperature:

Water temperature which itself is controlled by atmospheric temperature, governs the rate of physiological fluctuations in organisms and acts in combination with other water constituents, effect directly on aquatic life.

Present results showed arrange of surface water temperature 200 C to 350C and bottom water temperature 200C to 29.80C

in the Godhi Borsi Pond.

Zafar (1986) reported that the surface temperature was higher when turbidity was high and the turbidity decreased with a fall in the surface temperature.

Dwivedi(1986) reported the effect of temperature on fish production and based on data collected over a period of thirty-two years, concluded that for 100C rise is means mean temperature in unfertilized tanks, there was an increase of 22 kg of fish per hectare Year. This is in support and confirmation of the result of fish collected from this reservoir during 2022 and 2023. The higher fish production was in the month of April. Fish production was minimum in January high temperature favors fish production. Fish production is also directly related to the density of phytoplankton.

Fish Production:

The man had an interest in fish production because of its food and as well as medicinal values since time immemorial. Fish can be profitably grown in inland waters depending upon the physico-chemical conditions of the water body. A suitable environment is a must for an organism because the exchange of essential substances between the organism and its surroundings is essential for the maintenance of life. The numerical trend of fish production is closely related to abiotic and biotic components of the ecosystem.

The present study revealed that cyprinidae (carps) were the dominant fish and catla was a major contribution among carps. Carps are fast-growing fishes and popular preferred fishes from the point of view of their suitability. The following species were noted to be suitable for the Godhi Borsi Pond. Three indigenous major carps – Catla, Rohu, and exotic carps Common carp, were cultivated in the Pond.

Meehan (2002), Liang (1981), Kibria, (2017) & Ryder (1965) while studying the optimum range of temperature noted that major carp's flourished wall a temperature ranging from 180 to 300C. It is a common observation that the major carp have a wide range for tolerance of temperature a comparatively high temperature has always been preferred. In the present investigation, the range of temperature between 190 to 270C has been favored. During the present investigation, after compiling the data of the fishery department, two peaks of fish production were noted i.e. one during December and the other during April.

Noriega (1979) & Mathew (1990) reported for most of the indigenous fishes, that a concentration of dissolved oxygen between 2.0 to 10 ppm is quite favorable. During the present study, data reveals that dissolved oxygen was always within a favorable range.

The presence of carbon dioxide is considered an indicator of the biogenic condition of the water, especially its suitability for the fish. Anon (1991) reported that a concentration of free carbon dioxide up to 12 ppm has no adverse effect on major crops. During the present study, no significant effect of the free carbon

dioxide was observed because all the time it was always below the toxic limit. Das (1993), Natrajan (1979) & Durve (1976) observed that for proper development of freshwater fishes, a pH range between 5.0 to 9.0 has always been a preferable range. This is in agreement with the present investigation as the water of Godhi Borsi Pond was always alkaline.

Dissolved nutrients undoubtedly play an important role in fish production. It has been observed that the fish population showed a gradual decline in the summer months, which may be due to the low water level and high rate of evaporation. High temperature decreases the dissolved oxygen concentration of water, a further decrease in dissolved oxygen was enhanced by photo respiratory losses by floating vegetation due to increased light intensity. Thus oxygen was a limiting factor for the fishes.

Jhingran (1990) & Mcconnell (1963) have reported that a reduction in fish population may be due to the reduction of inorganic contents and dissolved oxygen in water. Chakraborti (1998) - Biology culture and production.

Fertilization with organic and inorganic fertilizers is now adopted as a necessary means of supplementary feed for obtaining high production in ponds Datta (2006) & Morash,(2015). According to Rawson (1952), mean depth and the fish production of large lakes.

The growth rate of common carp was better in comparison to Catla probably due to the wide range of tolerance of physicochemical factors and abundance of phytoplankton as studied by Bhatt (1986) & Wolny (1965) in experiments of compatibility of common carp and Catla. In general, growth was more in post-monsoon and at the beginning of the summer and low in the winter.

The decrease or increase in growth of fish is related to a decrease or increase in plankton and temperature fluctuations. Banerjee (1967) reported the release of nutrients by increased decomposition of organic matter at the bottom at higher temperatures. Wolny (1965) found an average increase of 22 kg/ha in carp yield for a 1000C rise in temperature. Observation of the growth rate of fishes in Maroda Pond is supported by studies of David (1974), Sreenivasan (1976), Welson (1920), Govind (1988), Anon (1991), Adholia (1992) & Das (2002).

CONCLUSION

The present investigation showed that the physico-chemical and biotic conditions of Godhi Borsi Pond are quite convincing and favorable for fish production. Hence the physico-chemical parameters are necessary aspects in the study of limnology. Different parameters such as Temperature, pH, Transparency, Total Hardness, Total alkalinity, Dissolved oxygen, Free Co₂, and Cl⁻, were assessed for fish production and climatic conditions play a very important role in the occurrence and distribution of aquatic biota. Dissolved nutrients undoubtedly play an important role in fish production. It has been observed that the fish population showed a gradual decline in the summer months as compared to the winter season, which may be due to the low water level and high rate of evaporation. A decrease or

increase in the growth of fish is related to a decrease or increase in plankton and temperature fluctuations. Proper management of the water of the reservoir is suggested to enhance the fish production in this area.

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